MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2019/2020

ECP3266 –ARTIFICIAL INTELLIGENCE AND APPLICATIONS

(ME / RE)

5 MARCH 2020
9.00 a.m. - 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of 5 pages excluding the cover page with 4 Questions only and appendix.

2. Attempt all **FOUR** compulsory questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please write all your answers in the Answer Booklet provided.

Question 1

a) Identify any TWO categories of Artificial Intelligence (AI) and briefly describe each category.

[5 marks]

b) Given two situations when data is labeled and data is unlabeled respectively. As an AI software engineer, propose a paradigm for each situation and justify your answer by showing the definition of the learning algorithms proposed.

[6 marks]

c) With the aid of diagram, show the differences between machine learning and deep learning.

[4 marks]

d) State and describe the four components of a problem in the context searching.

[8 marks]

e) Highlight the differences between informed and uninformed searches.

[2 marks]

Continued ...

Question 2

a) Consider a state space where the initial state is 1 and the successor function for any state n returns three states: $4n$, $4n + 1$, $4n + 2$.

i) Draw the search tree for states 1 to 26. [4 marks]

ii) Goal state is at 24. Determine the order in which the nodes will be expanded for the following uninformed search strategies:

- Breadth first search
- Depth-limited search with depth limit of 2
- Iterative deepening search

[3 x 2 marks]

b) Consider a game tree as shown in ***Figure Q2(b)*** for a two players game.

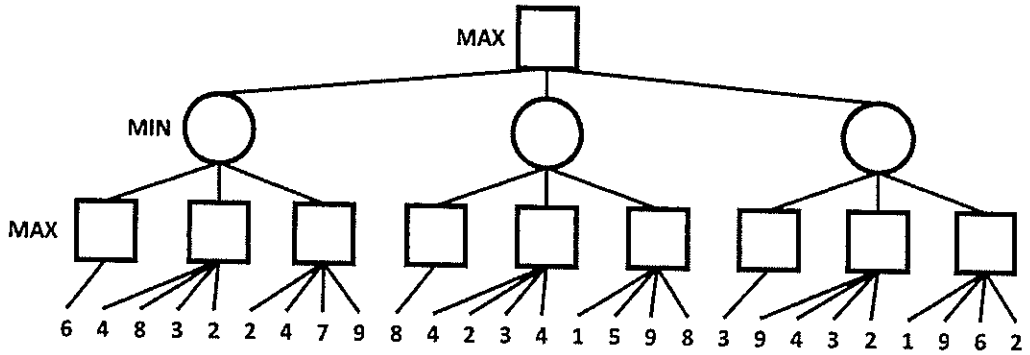

Figure Q2(b)

i) By applying minimax algorithm, redraw the game tree and fill in the utility values of each node.

[8 marks]

ii) Label the path that corresponds to MAX's best move and the MIN's best reply. [Hint: *Use the game tree in part (b)(i)*]

[2 marks]

iii) Cross out (×) the leaf nodes that would be pruned by alpha-beta pruning.

[Hint: *Use the game tree in part (b)(i)*] [5 marks]

Continued ...

Question 3

a) For each of the English sentences below, translate it to First-Order Logic (FOL) by using the following predicates:

$Engineer(x)$ denotes "x is an engineer"
$Programming(y)$ denotes "y is a programming language"
$Likes(x, y)$ denotes "x likes y"

i) "For every programming language, there is an engineer who likes that programming language"

ii) "There is an engineer who likes every programming language"

iii) "Some engineers like some programming languages"

iv) "There is a programming language that every engineer likes"

v) "For every engineer, there is a programming language that the engineer likes"

[5 x 2 marks]

b) Consider the following first-order logic sentences:

Premise:

"*Cars are vehicles.*"

$$\forall x\ Car(x) \Rightarrow Vehicle(x)$$

Conclusion:

"*The wheel of a car is the wheel of a vehicle.*"

$$\forall x, y\ Car(x) \wedge WheelOf(y, x) \Rightarrow \exists z\ Vehicle(z) \wedge WheelOf(y, z)$$

i) Convert the premise and the negated conclusion into Conjunctive Normal Form (CNF).

[10 marks]

ii) Based on the answer in part (i), construct a proof by refutation using resolution to show that the conclusion follows from the premise.

[5 marks]

Continued ...

Question 4

a) Determine whether the following propositions are valid or satisfiable using truth-table approach.

i) $\boldsymbol{P \vee (Q \Rightarrow Q)}$ [2 marks]

ii) $\boldsymbol{P \wedge \neg Q \wedge (P \Rightarrow R)}$ [4 marks]

b) Consider the following English sentences:

"*If AI is interesting and it is useful, then engineer applies AI to achieve high production yield. If engineer applies AI to achieve high production yield, then engineer's productivity increases. AI is interesting. AI is useful.*"

Using propositional logic and inference rules, infer that "*Engineer's productivity increases*". (Hint: *You may first define propositional symbols and convert the English sentences into propositional logic.*)

[9 marks]

c) Discuss the risks and opportunities caused by Artificial Intelligence (AI) for the future employment.

[8 marks]

d) Highlight the requirements for future employees in the era of emergence of Artificial Intelligence (AI).

[2 marks]

Continued ...

Appendix

Standard logical equivalences

The symbols α, β, and γ stand for arbitrary sentences of propositional logic.

$$
\begin{aligned}
(\alpha \wedge \beta) &\equiv (\beta \wedge \alpha) && \text{commutativity of } \wedge \\
(\alpha \vee \beta) &\equiv (\beta \vee \alpha) && \text{commutativity of } \vee \\
((\alpha \wedge \beta) \wedge \gamma) &\equiv (\alpha \wedge (\beta \wedge \gamma)) && \text{associativity of } \wedge \\
((\alpha \vee \beta) \vee \gamma) &\equiv (\alpha \vee (\beta \vee \gamma)) && \text{associativity of } \vee \\
\neg(\neg\alpha) &\equiv \alpha && \text{double-negation elimination} \\
(\alpha \Rightarrow \beta) &\equiv (\neg\beta \Rightarrow \neg\alpha) && \text{contraposition} \\
(\alpha \Rightarrow \beta) &\equiv (\neg\alpha \vee \beta) && \text{implication elimination} \\
(\alpha \Leftrightarrow \beta) &\equiv ((\alpha \Rightarrow \beta) \wedge (\beta \Rightarrow \alpha)) && \text{biconditional elimination} \\
\neg(\alpha \wedge \beta) &\equiv (\neg\alpha \vee \neg\beta) && \text{De Morgan} \\
\neg(\alpha \vee \beta) &\equiv (\neg\alpha \wedge \neg\beta) && \text{De Morgan} \\
(\alpha \wedge (\beta \vee \gamma)) &\equiv ((\alpha \wedge \beta) \vee (\alpha \wedge \gamma)) && \text{distributivity of } \wedge \text{ over } \vee \\
(\alpha \vee (\beta \wedge \gamma)) &\equiv ((\alpha \vee \beta) \wedge (\alpha \vee \gamma)) && \text{distributivity of } \vee \text{ over } \wedge
\end{aligned}
$$

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